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Labor Efficiency in Formula Feed Production

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U. S. DEPARTMENT OF AGRICULTURE

United States Department of Agriculture
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Preliminary Report

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PREFACE

This study was conducted by the U. S. Department of Agriculture with the help of the Midwest Feed Manufacturers' Association. The Midwest Feed Production School Committee assisted the Department in preparing the questionnaires used to obtain data on costs of formula feed operations. Production labor costs for June 1958 were requested in the first questionnaire and total costs for the formula feed operation during the plants' last fiscal year were obtained in the second questionnaire. These questionnaires were sent to a mailing list comprised of members of the Association and enrollees in Midwest Feed Production Schools in recent years.

The Department was responsible for all of the basic planning, analysis, and preparation of the report.

These data are being published in a preliminary report in order to make them available to the industry even though more information is necessary before a detailed analysis can be made. Subsequent surveys are planned to obtain this additional information.

Basic work of this type is part of the Department's broader program of research designed to expand market outlets and increase efficiency in marketing farm products. The farmer has a double stake in this industry's efficiency since he not only produces the feed ingredients but also is the purchaser of the final formula feeds.

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Labor Efficiency in Formula Feed Production

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INTRODUCTION

Formula feed production reached an all time high in 1958, an increase of about 40 percent over the 1949 tonnage. Costs of operating a formula feed plant also have changed considerably in recent years.

As has been the case in many other industries, capital expenditures for plant and equipment have been made which have reduced the amount of labor required per unit of output. In the prepared animal feeds industry the production man-hours required to produce a ton of formula feed decreased about 10 minutes per year between 1947 and 1954, according to the Census of Manufacturers. This implies a reduction of about 25 percent during the entire period.

Numerous Government and industry studies have analyzed the total costs and production labor costs of operating these formula feed mills. Some of them have studied the costs of performing specific operations through detailed observations.

While the overall cost studies have value in giving a general efficiency setting for the industry and the relative position of any given plant in this industry setting, additional efficiencies can be achieved only by more detailed analyses of specific operations. In this preliminary report, some information on the influence of volume on production labor inputs in specific cost centers or operations will be summarized. Later surveys and analyses will study production labor in each of the specific operations performed in the industry to (1) further analyze the influence of volume on production labor inputs in specific cost centers, and (2) to determine within volume groups which major types of equipment and operating techniques appear to be the most efficient in the use of production labor and capital expenditures.

METHODOLOGY

The data upon which this preliminary report is based were obtained primarily from a mail survey of plants regarding physical inputs of production labor and outputs of formula feed during the month of June 1958. Data on inputs of production labor and the outputs of feed were obtained for each of the seven major operations or cost centers involved in the mixing of feed.

Uniform definitions of the operation in each of these cost centers were made available at the November 1956 meeting of the Midwest Feed Production School. The following is a brief summary of the operations included in each cost center.

I. Ingredient Receiving

The cost center begins as the railroad car or truck is located at the unloading point.

The cost center ends as the raw materials and supplies are located at the point of rest either in the holding bins or in the receiving warehouse. It includes the work of turning or reconditioning all ingredients.

II. Grain Processing

The cost center begins with the grain to be processed in the grain storage bins.

The cost center ends as the processed grain is located in either mixing bins or ingredient storage bins.

III. Mixing

The cost center begins with the point of storage of the ingredients used in mixing.

The work includes the movement of all materials into the mixing area, weighing ingredients, and the actual mixing of premixes and the formula feed.

The cost center ends as the mixed feed comes to rest in holding bins at the next cost center.

IV. Pelleting

The cost center begins with the mixed feed located in holding bins over the pellet machines.

The cost center ends as the pellets or crumbles are moved into holding bins, either for packing or for bulk delivery.

V. Packing

The cost center begins with the mixed feed in the holding bins over the packers, or the holding bins over the molasses blenders.

The cost center ends after the bags leave the sewing machine.

VI. Warehousing

The cost center begins after the bags of finished feed leave the sewing machine, ready for shipping or warehousing.

The cost center ends after the rail cars and trucks have been loaded and ready for transport.

VII. Maintenance

This cost center includes all regular and preventive maintenance work throughout the mill.

In view of the availability of these cost center definitions and the school's "Cost Standards," many of the participating companies were expected to have used some or all of these cost center definitions in reorganizing their cost records. For this reason the assistance of the Midwest Feed Production School and Midwest Feed Manufacturers' Association was enlisted to help collect the basic information.

Specific plant information concerning the physical inputs and outputs for each specific cost center or operation was made available for 63 plants. Thirty-seven of these plants had previously adopted the use of these definitions. The remaining 26 used these definitions and maintained daily timecards for each production worker during the month of June 1958 in order to cooperate.

Seventeen of these 63 plants mixed less than 20,000 tons of feed per year, 16 mixed between 20,000 to 34,999 tons, 10 mixed 35,000 to 69,999 tons, and 20 mixed 70,000 tons or more of feed per year. A few very large plants were included among the cooperators.

Total operating cost records for the last fiscal year were also requested for each cooperating plant. Since none of the very large plants and less than one-half of the remaining smaller plants supplied these data, only a brief reference will be made to these annual cost records in this preliminary report. 1/

COST RELATIONSHIPS

Production labor costs are an important element in the costs of operating a formula feed mill. An analysis of the annual total costs of operating a formula feed mill, including procurement and selling costs but excluding the costs of ingredients, indicates that production labor costs represent between 40 and 66 percent of the total costs of operation.

These annual cost records also indicate that there is a tendency in the plants studied for production labor costs to be a larger proportion of total operating costs in the larger plants. However, this should not be assumed to

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1/ The response to this portion of the survey seems to indicate that only the companies having small and medium size plants have an interest in or a need for uniform accounting records covering their entire operations. Production cost information, however, seems to have a value to all companies, regardless of plant size.

be an industry tendency since the type of merchandizing organization has a tremendous influence on any given plant's expenditure for sales. The small number of plants supplying these annual data may be organized in such a way that the smaller ones spend more and the larger ones less for procurement and sales than other plants in the industry with comparable volumes.

Although the industry standards established by the 1956 Feed Production School research indicated that the grain processing and the packing cost centers should require a very small amount of production manpower, plants operating in the industry have not been able to achieve such low inputs in these cost centers (table 1). This may mean either that (1) the industry requires a different and more complicated type of operation than was assumed in the model plants used in establishing the industry standards, or (2) there is considerable room for improvement in these operations in the plants reported on in this study. On the other hand, a much more complicated warehousing operation appears to have been assumed for the small volume plant (table 1) in establishing the standard than is actually required in the industry.

Analysis of the data obtained from the 63 plants indicates that packing, mixing, and processing are the cost centers requiring the most inputs of production labor per ton in the small volume plants. In the larger plants warehousing and packing are the most important.

PHYSICAL OUTPUTS

The physical outputs for each of the various cost centers or operations are the only data which can be used in this report to analyze variations in production labor inputs. An earlier report, however, had shown that operating volume is the major factor influencing both total operating costs and total production labor inputs. 2/

It should be recognized, however, that individual plant operations differed somewhat among firms, as did the proportion of capacity utilized, the type of equipment used, the material flow pattern, and the management pattern of the labor used. While this analysis improves the level of knowledge because it considers individual production operations, it is expected that future surveys will further improve the analysis by permitting recognition of a number of these other factors in one or more specific cost centers.

Although this analysis considers the influence of the output of each cost center or operation on the production labor inputs, it is also possible that this tonnage, expressed as a proportion of the volume mixed, may have some bearing on this relationship. This may be especially true for certain cost centers or operations even though they need not necessarily handle all of the tonnage mixed. For example, not all of the tonnage mixed must be processed, pelleted, packed, or even warehoused. It is, however, reasonable

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2/ Brensike, V. J., and Askew, W. R., Costs of Operating Selected Feed Mills, Mktg. Res. Rept. No. 79, U. S. Dept. Agr., Washington, D. C. February 1955.

Table 1.--Production man-hours required per ton of mixed feed produced in plants with different volumes, by cost centers 1/

Cost centers	0 - 1,399 tons per month		1,400 - 2,899 tons per month		2,900 - 5,800 tons per month	
	Industry average 2/	Industry cost standard 3/	Industry average 2/	Industry cost standard 3/	Industry average 2/	Industry cost standard 3/
Ingredient receiving....	.268	.175	.192	.087	.218	.079
Grain processing...	.566	.041	.429	.021	.098	.009
Mixing.........	.646	.368	.285	.158	.169	.136
Pelleting......	.224	.128	.152	.081	.168	.051
Packing........	.884	.190	.352	.119	.300	.097
Warehousing....	.385	.724	.450	.337	.396	.292
Maintenance....	.191	.173	.135	.164	.129	.140
Total.....	3.164	1.799	1.994	.967	1.479	.804

1/ Each cost center contains its share of foreman's time.
2/ Average for plants reporting in its respective volume group.
3/ Industry cost standards for model plants with volumes approximately midway of the volume group.

to expect that all of the volume mixed will be received when considered over a longer period of time.

In order that the reader may have a picture of the relationship of these output volumes among the various cost centers, table 2 summarizes these data for the plants included when they are considered in groups on the basis of their mixing volumes. For rapid interpretation, these volumes are expressed as a portion of the average volume mixed in each group of plants. A review of table 2 seems to indicate that the influence of output volume may be either over or understated only in the receiving and pelleting cost centers. In these two cost centers the ratio of the cost center output to the mixing output does show a trend as both volumes increase.

Table 2.--Average tonnage in each cost center expressed as a percentage of the tonnage of feed mixed, June 1958

Tons of feed mixed	Tonnage					
	Received	Processed	Mixed	Pelleted	Packed	Warehoused
	Percent	Percent	Percent	Percent	Percent	Percent
0 to 1,399.........	75	46	100	94	60	96
1,400 to 2,899.....	98	37	100	83	84	107
2,900 to 5,799.....	95	56	100	68	72	98
5,800 and over.....	122	58	100	52	64	107

INPUTS OF PRODUCTION LABOR

General volume-cost relationships and some tentative conclusions will be discussed in this section, although no complete analysis of the inputs of production labor can be made from these preliminary data.

In establishing these relationships and tentative conclusions it should be noted that not all plants were used in each diagram. Some plants are excluded from the analysis for a given cost center because they reported production labor inputs for a combination of two cost centers and only an arbitrary method could have been used to obtain separate data. In addition a total of eight plant manhour-output relationships were excluded in each cost center either because the data were in error or they represent a type of operation which is completely different from those in all other plants. 3/

3/ One unusually high and one unusually low production labor input per ton was excluded in each of the four operating volume groups in each cost center to (1) make the general relationship more apparent, and (2) leave the group average approximately unchanged.

Actually these unusually high or low production labor inputs per ton may be the most important consideration in a future more detailed analysis. Differences in equipment used, product flow, or management of labor may explain the present apparent error or unexplainable differences in production

Previous analyses have indicated that both total operating costs per ton and, especially, total production labor costs per ton have tended to decrease rapidly as volume increases until an annual volume of about 25,000 tons per year is achieved. This analysis of production labor inputs per ton indicates that the processing, mixing, packing, and, to some extent, the pelleting operations have helped to cause these conditions. The warehousing, receiving, and maintenance operations have a more level relationship of volume and per unit costs even in the small operating volumes.

Small Volumes and Higher Costs

Small volumes mean much higher per unit costs in the processing, mixing, packing, and pelleting cost centers (figs. 1, 2, 3, and 4). In the scattergram each "dot" represents a plant. Each "X" represents the average manhour-output relationship for the four respective size groups shown in table 2. The average relationship shown is only approximate and is based primarily on the group averages. However, it gives a picture of the general pattern of the relationship among the individual plants.

Certainly, both the variation in per unit labor inputs and the influence of volume in the small plant operations in each of these cost centers indicate a considerable possibility for increased efficiency. Despite the slight impact of volume on per unit labor inputs in the larger volume plants, the greater dispersion in the packing and mixing cost centers again shows possibility for greater efficiency in certain plants. While this possibility also exists for pelleting and processing, the size of the possible savings is much smaller.

Volume Has Little Influence on other Operations

Even in the small volume operations volume has very little influence on the per unit inputs of production labor in the warehousing, receiving, and maintenance operations (figs. 5, 6, and 7). Even in these cost centers the variations in costs among the small volume plants are considerable, again indicating significant possibilities for increased efficiency in many plants.

Variations in production labor inputs, especially in the warehousing cost center in the larger volume plants, also show the possibilities for increased efficiency in many plants.

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labor inputs. For present purposes of analysis, however, these plant data must be excluded as either being due to considerably different operating conditions or being in error.

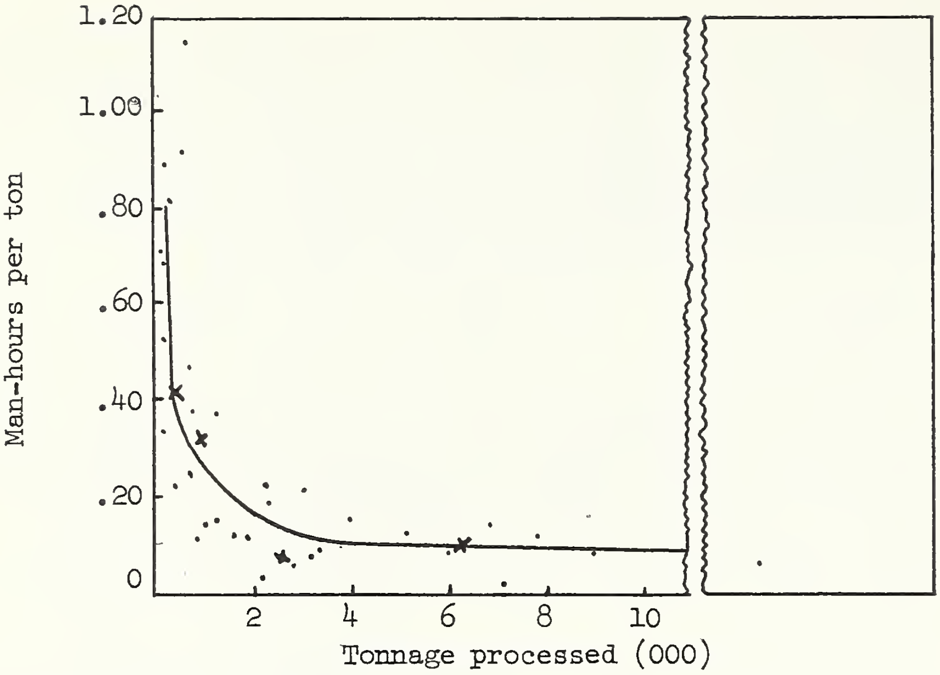

Figure 1.--Processing cost center -- Inputs of production labor and volume handled per plant, June 1958

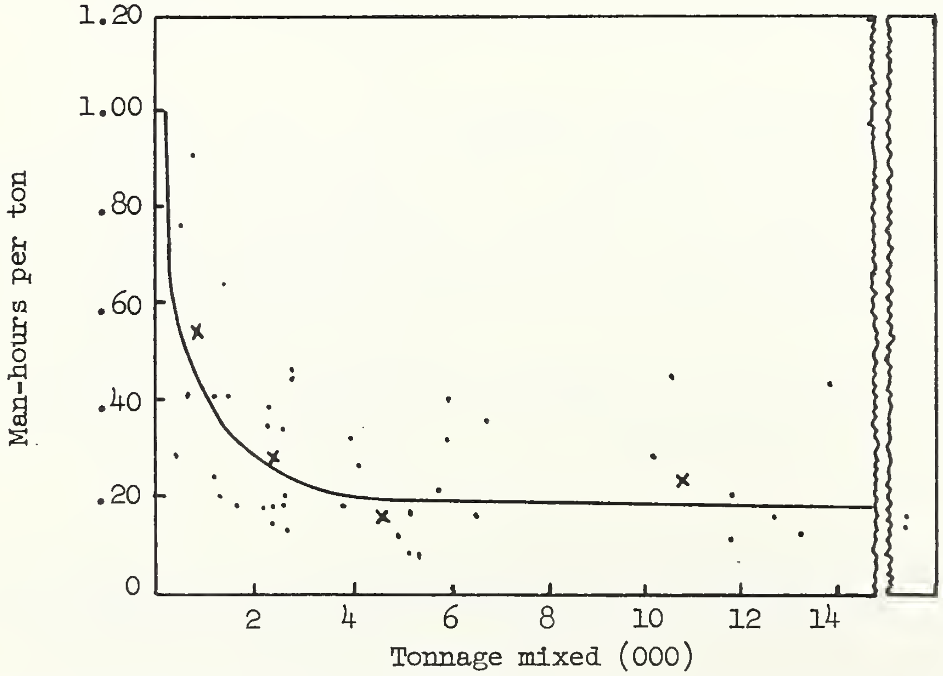

Figure 2.--Mixing cost center -- Inputs of production labor and volume handled per plant, June 1958

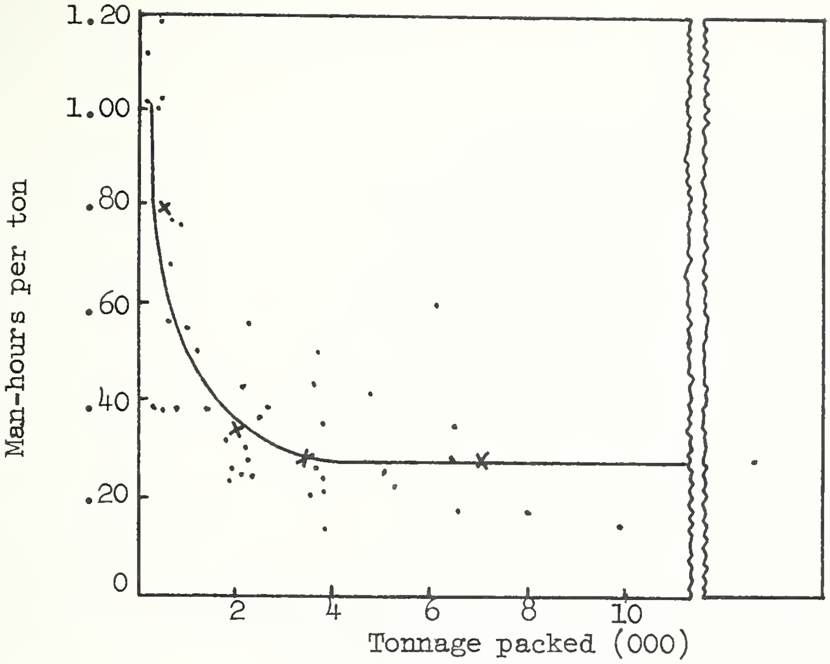

Figure 3.--Packing cost center -- Inputs of production labor and volume handled per plant, June 1958

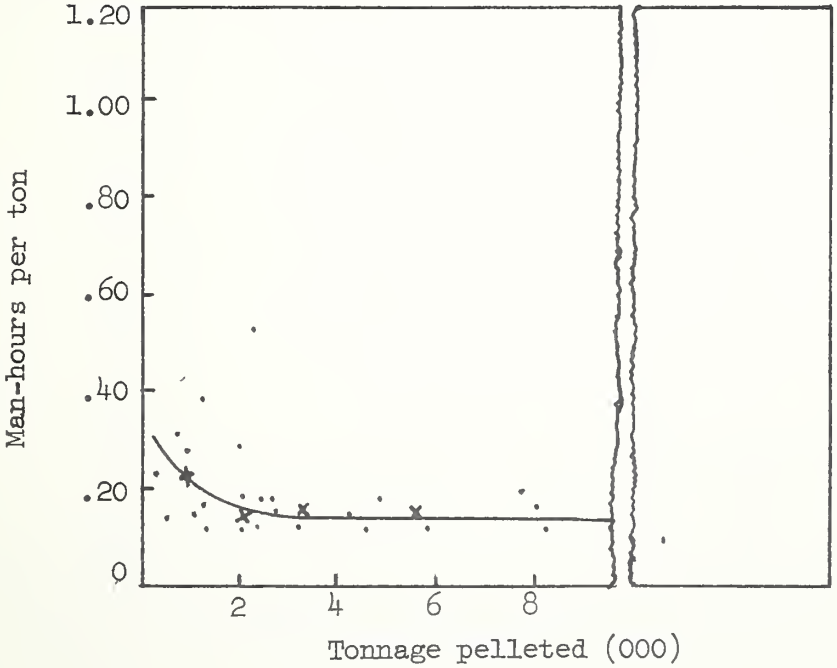

Figure 4.--Pelleting cost center -- Inputs of production labor and volume handled per plant, June 1958

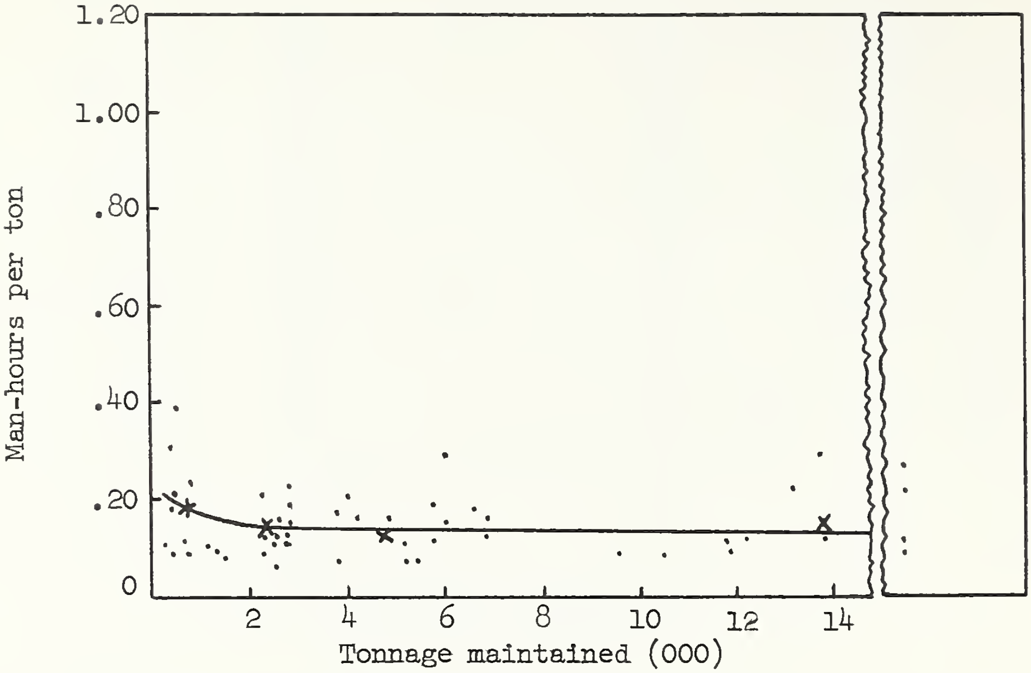

Figure 5.--Maintenance cost center -- Inputs of production labor and volume handled per plant, June 1958

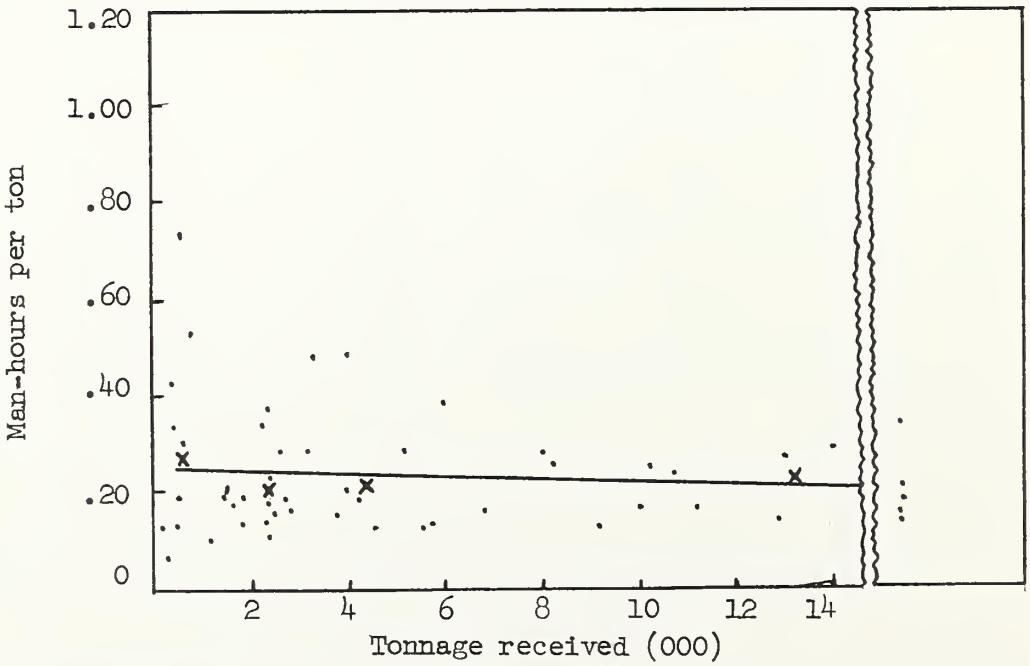

Figure 6.--Receiving cost center -- Inputs of production labor and volume handled per plant, June 1958

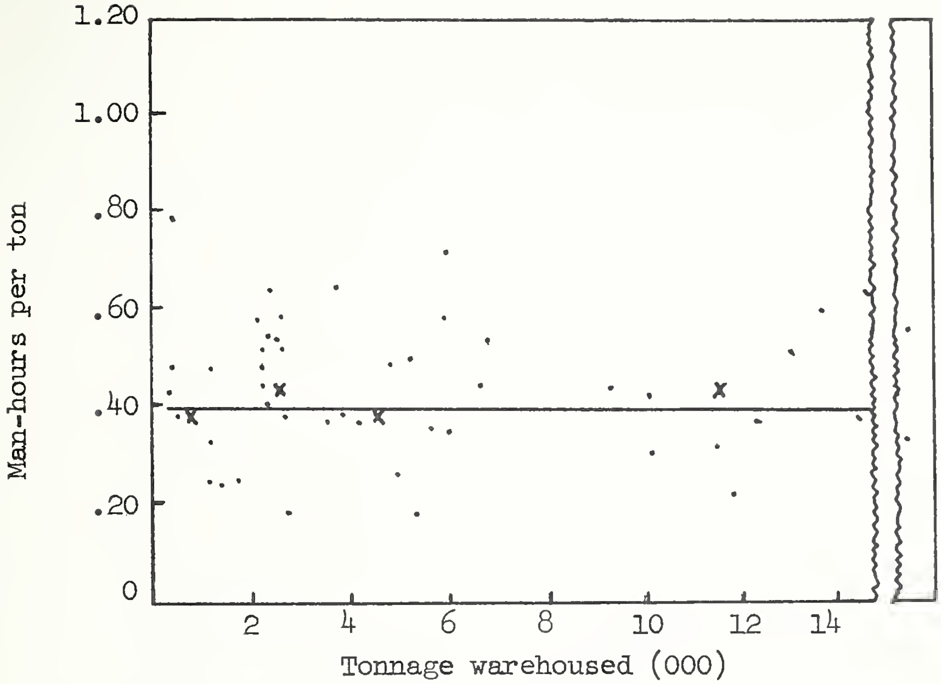

Figure 7.--Warehousing cost center -- Inputs of production labor and volume handled per plant, June 1958